



Pest Facts

Domestic Rodents

Domestic rodents, including the Norway rat, roof rat and house mouse, are responsible for extensive economic damage (i.e., product fouling and consumption, facility and equipment destruction) and vectoring human illness (i.e., rat-bite fever, leptospirosis, salmonellosis, trichinosis, murine typhus, plague, rickettsial pox, lymphocytic choriomeningitis, toxoplasmosis and listeriosis).

Because domestic rodents are characterized by outstanding adaptability to a variety of situations, designing a successful and sustainable management program is often challenging, requiring an understanding of rodent biology and employing chemical and non-chemical techniques aimed at exploiting behavioral characteristics. The following information is designed to provide a foundation upon which to build a successful domestic rodent integrated management program. Clearly, however, each situation is different, requiring specific modification to this general plan. Therefore, contact your local pest management professional or DSCP for more information.

BIOLOGY

Norway rat

The Norway rat (*Rattus norvegicus*), predominantly a burrowing rodent, is the most common and the largest of the domestic rats. It is distributed throughout the temperate regions of the world, including the United States. Common names given to this species include the brown rat, house rat, barn rat, sewer rat and wharf rat.

Characteristics

Body: Heavy/stocky

Body weight: 7-18 ounces (200-500 grams), adults average approximately 1 pound (450 grams).

Length of head and body: 7-10 inches (180-255 mm).

Tail: Length 6-8.5 inches (150-215 mm); shorter than head plus body, dark above, pale below.

Total length: 13-19 inches (325-460 mm)

Fur: Coarse, usually brownish or reddish-gray above, whitish on the stomach with gray under-fur. Entirely black individuals are found in the United States.

Nose: Blunt

Ear: Small, close-set, with fine hairs, appears half buried in fur, does not reach eyes. Rarely over $\frac{3}{4}$ " (20 mm) long.

Eye: Small, black

Droppings: Large, up to $\frac{3}{4}$ " (20 mm) long, capsule-like, often with blunt ends.

Sexual maturity: Reached in 3-5 months after birth

Gestation period: About 22 days

Young: 8-12 per litter, about 20 weaned

Number of litters: About 4-7/year

Life expectancy: Maximum about 12 months

Harborage: Outdoors- in burrows in the ground and under building foundations, garbage dumps and sewers

Indoors- between floor and ceiling and in walls, in enclosed spaces of cabinets, shelving, and appliances, in piles of debris often left undisturbed and other concealed places.

Range: 100-150 ft (30-50 meters)

Food: Garbage, meat, fish, vegetable, fruit and cereals. Daily requirements- $\frac{3}{4}$ to 1 ounce (22-30 grams) of dry food, more of moist food.

Water: Daily requirement, $\frac{3}{4}$ -1 ounce (15-30 ml)



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Roof Rat

The roof rat (*Rattus rattus*) is somewhat smaller than the Norway rat and is a more agile climber. In the United States its range is almost entirely confined to southern regions, Pacific Coast and Hawaii. It is abundant in tropical and sub-tropical regions of the world but is rare or absent in colder regions.



Characteristics

Body: Slender, graceful

Body weight: Four-12 ounces (110-430 grams), adults average $\frac{1}{2}$ - $\frac{2}{3}$ pound (225-300 grams).

Length of head and body: Six and one half to 8 inches (165-205 mm).

Tail: Length $7\frac{1}{2}$ to 10 inches (190-255 mm). Longer than head plus body, uniformly colored.

Total length: Fourteen to 18 inches (350-450 mm)

Fur: Fine body hair and long, prominent, guard (cover) hairs. Three color phases have been recognized: black rat (*Rattus rattus rattus*), which is black to slate-gray; the Alexandrine rat (*Rattus rattus alexandrinus*), which is brownish on top and grayish-white on the bottom; and the fruit rat (*Rattus rattus frugivorus*) which is brownish above and white to lemon yellow on the bottom. All three subspecies interbreed and different color variants may occur.

Nose: Pointed

Ear: large, prominent, hairless, stands out from the fur, can be pulled over the eye. Generally more than $\frac{3}{4}$ " (20 mm) long.

Eye: large, black

Droppings: medium size, up to $\frac{1}{2}$ " (13 mm) long, sausage or banana-shaped, ends often pointed.

Sexual maturity: reached in 3-5 months after birth.

Gestation period: about 22 days

Young: often 6-8 per litter, about 20 weaned per female

Number of litters: about 4-6 per year

Life span: maximum about 1 year.

Harborage: Above ground- indoors, in attics, between floors and ceilings and in walls, and in enclosed spaces of cabinets and shelving. Above ground-outdoors, in trees and dense growth.

Range: often 100-150 feet (30-50 meters)

Food: vegetables, fruits and cereals preferred; daily requirement, $\frac{1}{2}$ - 1 ounce (15-30 grams) of dry food, more of moist food.

Water: daily requirement, up to 1 ounce (30 ml).

House mouse

The house mouse (*Mus musculus*) is abundant throughout the United States and found throughout the world (temperate, tropical and sub-tropical areas).



Characteristics

Body: slender, graceful

Body weight: one half to $\frac{3}{4}$ ounce (14-21 grams)

Length of head and body: two and $\frac{1}{2}$ to 3 $\frac{1}{2}$ " (65-90 mm)

Tail: three to 4 inches (75-100 mm), Equal to, or barely exceeding the head plus body, uniformly grayish.

Total length: Five and $\frac{1}{2}$ -7.5 " (140-190 mm)

Fur: fine, brownish-gray on back, gray on stomach

Nose: pointed

Ear: large, prominent with some hairs, can be pulled over eye. Usually $\frac{1}{2}$ " (13 mm) long.

Eye: Very large compared to the size of the head, black

Droppings: small, up to $\frac{1}{4}$ " (7 mm) long, rod- or spindle shaped.

Sexual maturity: reached in 1.5 to 2 months after birth.

Gestation period: about 19 days.

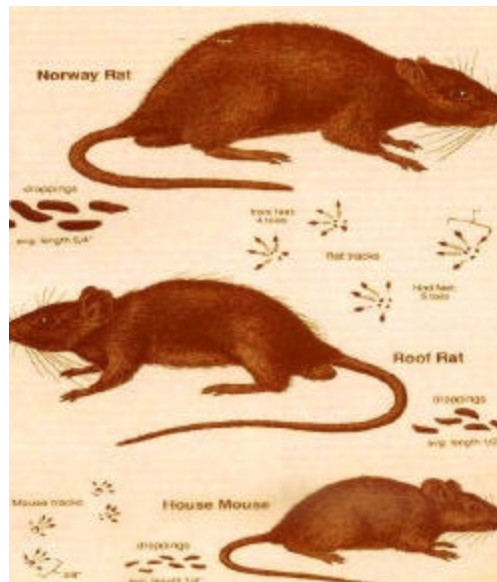
Young: often 5-6 per litter/ 30-35 weaned per female

Number of litters: as many as 8 per year

Life expectancy: maximum of less than a year

Harborage: Indoors-any convenient space between walls, cabinets, furniture, debris, stored goods.

Outdoors- vegetation, debris, unused equipment



Range: 10-30 feet (3-10 meters)

Food: cereal grains preferred, but most types of edible materials; the mouse is a nibbler; daily requirement $\frac{1}{10}$ ounce (3 grams) of dry food, more of moist food.

Water: daily requirement, $\frac{3}{10}$ ounce (9 ml); however, can live and grow in dry habitats and use metabolic water in the food to meet the requirement.

Rodent Senses, Agility and Reactions

Touch: Well developed in highly sensitive whiskers, or vibrissae, and in certain guard (tactile) hairs. Rats and mice prefer to run along walls, between things or in runways where they can keep their whiskers in contact with vertical or side surfaces.

Vision: Not well developed. Rodents are color blind, so distinctive of poison baits does not reduce their acceptance. Their vision is adapted to dim light. They can distinguish between object shapes and detect motion at distances up to 45 feet.

Smell: Keen sense of smell. Rodents apparently like the odors of most foods consumed by man. They are used to the odor of man.

Taste: Well-developed. Rats and mice will eat most foods that man will eat and prefer fresh food to spoiled food. Rats associate sickness caused by poison bait with the bait, not the poison.

Hearing: Well-developed. Rodents can locate the source of a noise within 6 inches. Loud noises cause rodents to leave buildings. Ultrasonic sound does not repel rodents.

Balance: Excellent. A falling rodent will always land on its feet.

Reaction to Strange Objects: Rats may avoid new sounds or a strange object in their environment for three or more days, particularly if other rodents are alarmed by it. Other objects are readily accepted (food, garbage). Mice are naturally inquisitive.

Climbing: Roof rats and house mice are good climbers. Norway rats less so, but will climb if forced to do so.

Jumping and Reaching: Rats can jump nearly 2 feet vertically, 3 feet a running jump. They can jump 4 feet horizontally, and 8 feet from an elevation that is 15 feet above the landing zone. Rats can reach about 13 inches. Mice can achieve proportionally less distances.

Swimming: Rodents are good swimmers. They are able to swim up through floor drains and toilets.

Seasonal Abundance: Outdoor rodent populations tend to peak in summer to early fall. They tend to be at their lowest levels in late winter to early spring. Indoor rodent populations may remain at the same levels throughout the year, limited only by periodic shortages of food, water or nesting sites.

Recognizing the Signs of Rodents-Surveillance

Periodic surveys of buildings and grounds can reveal the presence of rodents. Surveillance should be conducted weekly and increased or decreased according to the severity of the problem. Because rodents are usually nocturnal and secretive and are rarely seen during the day except when infestations are heavy, evening inspections using a powerful flashlight is the best means by which to see rodents. However, there are many signs of an infestation in addition to seeing the animal. These signs are found along walls, under piles of debris/pallets, under boxes, boards, near thick vegetation in the form of droppings, sounds, burrows, nests, urine stains, runways, smudge marks, tracks, gnawings, food caches, and odor. From rodent signs, you will be able to determine what species is present and whether there is a current or old, heavy or light infestation

Droppings

Fresh droppings of feces are usually moist, soft, shiny and dark, but in a few days they usually become dry and hard (this differs in humid environments). Old droppings are dull gray, crumble when pressed with a stick and are often moldy or covered with fungi. When examined under magnification, hairs are usually white in rodent droppings. Cockroach droppings never contain hair. Insect parts may also be found in rodent droppings.

Runways

Rats habitually use the same runways between food, water and harborage. Because of the uniquely developed sense of touch in their whiskers and in specialized hairs along the body, rats prefer continual body contact with at least one vertical surface, such as a wall. Outdoors, these runways are narrow pathways of beaten earth swept clear of debris. Indoors, greasy runways are found along walls, steps and rafters. Undisturbed cobwebs and dust in a runway indicate it is not in use.

Rubmarks

Along regularly traveled runways, a dark greasy mark forms from contact by the rodent's body. Fresh marks are soft and will smear if rubbed. As the grease ages, it dries and gathers dust and will flake off when scratched. The rubmarks of the Norway rat are most commonly found along their runways near ground or floor level, while those made by the roof rat are most commonly seen overhead as swing marks beneath beams or rafters at the point where they connect to the walls. Mice do not leave detectable rubmarks unless an infestation is heavy.

Burrows

The Norway rat prefers burrows for nesting and harborage; the roof rat burrows only occasionally. Burrows are found in earth banks, along walls, under debris or concrete slabs and in similar places. If a burrow is in use, its entrance will be free of cobwebs and dust. Fresh rubmarks on hard-packed soil at the opening indicate a well established and presently used burrow. The presence of fresh food particles or freshly dug soil at the burrow entrance also indicates current use. Burrows are seldom far from food and water sources.

Gnawings

The incisor teeth of rats grow at a rate of 4-6 inches/year, so these rodents must gnaw each day to keep their teeth short enough to use. Rats gnaw to gain entrance and obtain food. When gnawings in wood are fresh, they are light colored and show distinct tooth marks. Small chips of wood or other materials indicate recent gnawing. With age, wood gnawings become dark and smooth from weathering and frequent contact with the rodents body.

Tracks

Fresh tracks are sharp and distinct, whereas old tracks are covered with dust and are therefore less distinct. The tracks of the 5-toed rear paws are more commonly observed than are those of the 4-toed front paws, but both may be present. Smooth tracking patches of any dust material, such as flour or talc, placed along runways may indicate recent rodent activity. To see tracks in the dust, hold a flashlight at an acute angle that causes the tracks to cast distinct shadows. Tail marks are often visible as well.

Urine and Hair

Rodents are incontinent and will urinate at any time while feeding or traveling. Dry rodent urine glows or fluoresces bluish-white if fresh to a yellowish-white if old when exposed to ultraviolet or black light. Patterns will be spotted (drops) along runways to larger spots near food/water sources and harborages. Urine stains may also be observed on top of boxes or shelving in a drop-like pattern. Rodent hair will fluoresce white when exposed to UV light. Because other substance will fluoresce when exposed to black light, this is a presumptive test which requires experience to analyze accurately. Potentially positive results should be verified with other signs of infestation.

Seasonal abundance

Outdoor rodent populations tend to peak in summer to early fall. They tend to be at their lowest levels in late winter to early spring. Indoors, rat populations may remain at the same levels throughout the year limited only by periodic shortages of food, water, or nesting sites.

Sounds: Squeaks, gnawing, clawing and scrambling in walls are typical rodent sounds.

Food caches: Rodents may store a large quantity of food in protected areas. Check for an abundance of food products stored in hidden areas of the facility.

Odor: Heavy infestations have a distinctive, musty, strong odor.

Evaluation of Population Size

Rodent-free or low population density: No sign of rodent presence

Medium population density: Old droppings and gnawing common, one or more rats seen by flashlight surveillance, none during the day. Each rodent seen during the day usually indicates 10 or more are in the facility.

High population density: Fresh droppings, tracks, gnawing evident, three or more rodents seen at night, one or more during the day.

Estimates of rats present can also be made by placing pre-measured, ground, non-toxic cereal bait in various locations to determine how much is eaten each night. Double the amount each night until the amount taken in one night levels off. Divide the amount by ½ ounce. This will provide a very rough estimate of the minimum number of rats present.

Management Techniques

Non-chemical

Successful rodent management programs use a combination of tools, procedures and strategies. Non-chemical techniques include improving sanitation, reducing resource base, accesses and harborages.

Sanitation

Food in warehouses should be rotated properly (first in, first out). Products should be stored off the ground on pallets or shelving made of impermeable materials. There should be at least 18" of space between pallets, stacks and the wall to allow for proper inspection and control.

Harborage Reduction

Landscaping should not include thick hedges, shrubs or heavy ground cover. All vegetation should be approximately 24" from the building. All overhanging vegetation should be removed. High or dense grass, weeds, and wood piles/debris should not be permitted near foundations. Indoors, reduce clutter, especially in storage areas and rarely used rooms.

Rodent Proofing

- Block openings around water and sewer pipes, utility lines and air vents
- Install metal kick plates or sweeps on doors and metal jambs on windows and doors.
- Ensure adequate lighting, especially around exterior entrances and in storage areas.
- Seal any cracks or holes in foundations (above and below grade) and exterior walls.
- Repair damaged roofing
- Repair gnaw holes by stuffing with steel or copper wool or patch with stainless steel.
- Equip floor drains with sturdy metal grates

Trapping

Traps (glue boards, snap, repeating) are especially useful when you wish to avoid the use of poisons, to eliminate bait shy or bait resistant rodents, to avoid odors from dead rodents in inaccessible places, to collect rodents for ectoparasite or resistance screening.

When using snap traps, choose those with expanded triggers (treadles) set for a light touch. For all traps, set trigger or entrance perpendicular or toward the wall and secure. Put several traps side-by-side along runways or where rodent activity is observed (prevents rodents from jumping over them). Before baiting traps, place them out without setting for three to four nights to allow rodents to become accustomed to them. Bait traps with food the rodents are feeding on in the facility.

Chemical

Rodenticides are commonly used to provide rapid reduction in rodent populations. Often, rodents will die in hard to access areas causing an odor and attracting insects. Therefore, attempt other techniques in addition or instead of chemicals. Remember, chemicals may only be used by a certified pest manager.

Toxic Baits: These combine a poison with a food bait attractive to rodents. Today, most baits are obtained ready-made as pellets, in dry meal or molded into a block. Because most baits are grain-based (taking advantage of natural rodent food preference), they may also serve as a resource for several stored product pest arthropods.

Some baits kill rodents in a single feeding (recommended), some require that a rodent feed a number of times. Some are anticoagulants, some affect respiration, some stomach poisons and others work by different modes of action.

Every rodenticide has a warning label to place the bait in "locations not accessible to children, pets, wildlife, and domestic animals, or in a tamper resistant box." What qualifies

as safe, inaccessible and effective placement needs to be determined by a pest management professional.

Water Baits: These formulated rodenticides are mixed with water and dispensed from specially designed containers. Since rats drink daily, water baits are effective when free water is in short supply. Water baits are not effective against mice and not as effective against roof rats. Be sure that they are used where no other animal or child may access them.

Tracking Powders: These are rodenticides mixed with talc or powdery clay and applied to areas where rodents travel. The powder sticks to the rodent's feet and fur and is swallowed during grooming. Tracking powders are effective even when food and water are present.

Because the rodenticide in tracking powders is 5-40 times more concentrated than baits, avoid applying where the powder could become airborne and drift into non-target areas.

For additional information regarding rodent management, please contact the DSCP-West Coast Support Office at DSN 686-8122, commercial (510) 337-8122 or email paa5245@exmail.dscp.dla.mil

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